

SUPPLEMENTAL EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Craig Summerfield on August 27, 2009.

IN THE CLAIMS:

Claim 1. A medical diagnostic ultrasound system comprising:

a plurality of subsystems along an ultrasound data processing path including a beamformer subsystem, a Doppler processor subsystem, an RF processor subsystem, and a scan converter subsystem;

wherein one of the subsystems has ~~subsystem having~~ an essential data processing functionality, the essential data processing functionality including data processing of ultrasound data, the essential data processing functionality of the subsystem largely residing in at least one but less than three reprogrammable logic device components;

wherein for the beamformer subsystem, the essential data processing functionality comprises filtering, interpolating, demodulating, phasing, apodization, delaying, summing or combinations thereof;

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wherein for the Doppler processor subsystem, the essential data processing functionality comprises clutter filtering, auto-correlation, estimating velocity, variance, or energy, or combinations thereof;

wherein for the RF processor subsystem, the essential data processing functionality comprises detecting an envelope, amplitude or power, log compressing or combinations thereof; and

wherein for the scan converter subsystem, the essential data processing functionality comprises interpolation.

Claim 5. The diagnostic ultrasound system subsystem of claims 1, 2, 3, or 4, wherein the subsystem is a the scan converter subsystem.

Claim 6. The diagnostic ultrasound system subsystem of claims 1, 2, 3, or 4, wherein the subsystem is a the transmit beamformer subsystem.

Claim 7. The diagnostic ultrasound system subsystem of claims 1, 2, 3, or 4, wherein the subsystem is a the receive beamformer subsystem.

Claim 9. The diagnostic ultrasound system subsystem of claim 8 wherein the at least two subsystems comprise a the transmit beamformer, a the receive beamformer, and a the scan converter subsystems.

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Claim 10. The diagnostic ultrasound system subsystem of claims 1, 2, 3, 4, ~~5, 6, 7,~~
~~8~~ or ~~9~~ 4 wherein the diagnostic ultrasound system is portable.

Claim 11. A medical diagnostic ultrasound method for processing with a
subsystem, the method comprising the acts of:

(a) processing ultrasound data as an essential data processing
functionality of the subsystem, the processing performed by at least one but less
than three re-programmable logic device in the subsystem; and

(b) providing the essential data processing functionality of the subsystem
largely resident in the reprogrammable logic device components;

wherein for a beamformer subsystem, the essential data processing
functionality comprises filtering, interpolating, demodulating, phasing, apodization,
delaying, summing or combinations thereof;

wherein for a Doppler processor subsystem, the essential data processing
functionality comprises clutter filtering, auto-correlation, estimating velocity,
variance, or energy, or combinations thereof;

wherein for a RF processor subsystem, the essential data processing
functionality comprises detecting an envelope, amplitude or power, log compressing
or combinations thereof; and

wherein for a scan converter subsystem, the essential data processing functionality comprises interpolation.

Claim 21. A medical diagnostic ultrasound system for beamformation, the system comprising:

a beamformer comprising at least one re-programmable logic device means operable to generate transmit waveforms, delay ultrasound data or waveforms, apodize across channels or sum ultrasound data; and

a transducer operatively connected with the beamformer.

Claim 24. The system of Claim 21 wherein the re-programmable logic device means comprises a field programmable gate array.

Claim 25. The system of Claim 21 wherein an essential functionality of the beamformer resides in the re-programmable logic device means.

Claim 26. A medical diagnostic ultrasound method for beamformation, the method comprising the steps of:

(a) beamforming data with at least one re-programmable logic device means; and

(b) transmitting data between the re-programmable logic device means and a transducer.

Claim 27. The method of Claim 26 wherein (a) comprises generating digital transmit waveforms with the re-programmable logic device means.

Claim 30. The method of Claim 26 further comprising:

(c) providing an essential functionality of the beamformer resident in the re-programmable logic device means.

Claim 46. The system of Claim 23 wherein the at least one re-programmable logic device means comprises a memory operable to delay received signals.

Claim 47. The system of Claim 28 wherein (a) comprises delaying received signals with a memory integrated with the one programmable logic device means.

Claim 59. The system of Claim 21 wherein the at least one re-programmable logic device means comprises a single re-programmable logic device.

Claim 63. The method of Claim 26 wherein (a) comprises beamforming wherein the at least one re-programmable logic device means comprises a single re-programmable logic device.

Claims 31-45 (cancelled).

Claim 65 (cancelled).

Claim 67 (cancelled).

The following is an examiner's statement of reasons for allowance:

The prior art of record of Wright et al. disclose a flexible beamformer system (col. 4, lines 38-41). Cole et al. disclose using a field programmable gate array for implementing a multiplexer scheme (col. 12, lines 48-52). However, the field

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programmable gate arrays of Cole et al. are not used for data processing, only data routing. Neither Wright et al. nor Cole disclose re-programmable logic device components for implementing a programmable beamformer system wherein for a beamformer subsystem, the essential data processing functionality comprises filtering, interpolating, demodulating, phasing, apodization, delaying, summing or combinations thereof; wherein for a Doppler processor subsystem, the essential data processing functionality comprises clutter filtering, auto-correlation, estimating velocity, variance, or energy, or combinations thereof; wherein for a RF processor subsystem, the essential data processing functionality comprises detecting an envelope, amplitude or power, log compressing or combinations thereof; and wherein for a scan converter subsystem, the essential data processing functionality comprises interpolation as now amended claims 1 and 11.

At least, for similar reasons above claims 21 and 26 require a beamformer comprising at least one re-programmable logic device means components, such as FPGA's and PLD's devices for implementing a programmable beamformer system.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JOHN F. RAMIREZ whose telephone number is (571)272-8685. The examiner can normally be reached on (Mon-Fri) 7:00 - 3:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Brian L. Casler can be reached on (571) 272-4956. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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